

SEQUENCE LISTING

<110> Allen, Stephen M.
Caimi, Perry G.
Stoop, Johan M.

<120> Fructan Biosynthetic Enzymes

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<150> 60/244,273

<151> 2000-10-10

<150> 60/269,543

<151> 2001-02-16

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<213> *Dimorphotheca sinuata*

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<212> PRT
<213> Dimorphotheca sinuata

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Leu Ile Val Ser Val Leu Phe Leu Asn Gln Gln Asn Ser Ser His Ser
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Thr Thr Asn Ser Lys Ser Ile Ser Gln Ser Asp Arg Leu Ile Trp Glu
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Arg Thr Ser Phe His Phe Gln Pro Ala Lys Asn Phe Ile Tyr Asp Pro
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Asn Gly Pro Leu Phe His Met Gly Trp Tyr His Leu Phe Tyr Gln Tyr
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Asn Pro Tyr Gly Pro Val Trp Gly Asn Met Ser Trp Gly His Ser Val
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Ser Lys Asp Met Ile Asn Trp Phe Glu Leu Pro Val Ala Leu Val Pro
      130          135          140

Thr Glu Trp Tyr Asp Ile Glu Gly Val Leu Ser Gly Ser Thr Thr Val
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Leu Pro Asn Gly Gln Ile Phe Ala Leu Tyr Thr Gly Asn Ala Asn Asp
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Phe Ser Gln Leu Gln Cys Lys Ala Val Pro Val Asn Ile Ser Asp Pro
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Leu Leu Ile Glu Trp Val Lys Tyr Asp Gly Asn Pro Ile Leu Tyr Thr
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Pro Pro Gly Ile Gly Leu Lys Asp Tyr Arg Asp Pro Ser Thr Val Trp
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Thr Gly Pro Asp Gly Lys His Arg Met Ile Met Gly Ser Lys Arg Asn
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Lys Thr Gly Leu Val Leu Val Tyr His Thr Thr Asp Phe Thr Asn Tyr
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<211> 2146
<212> DNA
<213> *Parthenium argentatum* Grey

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<212> PRT
<213> *Parthenium argentatum* Grey

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Phe	Phe	Ile	Ser	Ala	Phe	Leu	Phe	Ile	Val	Leu	Asn	Gln	Gln	Asn	Ser	
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Phe	Ser	Gln	Leu	Gln	Cys	Lys	Ala	Val	Pro	Val	Asn	Ser	Ser	Asp	Pro	
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 Asp Asn Ala Asp Asp Asp Leu Ser Arg Gly Trp Ala Thr Ile Tyr Asn
 370 375 380
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 405 410 415
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 Gly Thr Ala Thr Gln Leu Asp Ile Val Ala Thr Phe Lys Val Asp Glu
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 Ala Ala Leu Asn Ala Thr Ser Glu Thr Asp Asp Asn Phe Ala Cys Thr
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 Ala Val Leu Ala Asp Gly Thr Leu Ser Glu Leu Thr Pro Val Tyr Phe
 485 490 495
 Tyr Ile Ala Lys Lys Ala Asp Gly Gly Val Ser Thr His Phe Cys Thr
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 Asp Lys Leu Arg Ser Ser Leu Asp Phe Asp Lys Glu Arg Val Val Tyr
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 Gly Ser Thr Val Pro Val Leu Asp Asp Glu Glu Leu Thr Met Arg Leu
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<211> 1333

<212> DNA

<213> Helianthus sp.

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<212> PRT
<213> Helianthus sp.

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Thr Asp Tyr Thr Asn Tyr Glu Leu Leu Asp Glu Pro Leu His Ser Val
  35              40              45

Pro Asn Thr Asp Met Trp Glu Cys Val Asp Phe Tyr Pro Val Ser Leu
  50              55              60

Thr Asn Asp Ser Ala Leu Asp Met Ala Ala Tyr Gly Ser Gly Ile Lys
  65              70              75              80

His Val Ile Lys Glu Ser Trp Glu Gly His Gly Met Asp Trp Tyr Ser
      85              90              95

Ile Gly Thr Tyr Asp Ala Ile Asn Asp Lys Trp Thr Pro Asp Asn Pro
  100             105             110

Glu Leu Asp Val Gly Ile Gly Leu Arg Cys Asp Tyr Gly Lys Phe Phe
  115             120             125

Ala Ser Lys Ser Leu Tyr Asp Pro Leu Lys Lys Arg Arg Val Thr Trp
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Ala Tyr Val Gly Glu Ser Asp Ser Val Asp Gln Asp Leu Ser Arg Gly
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 Arg Tyr Asn Gly Gln Glu Phe Lys Glu Ile Glu Leu Glu Pro Gly Ser
 195 200 205
 Ile Ile Pro Leu Asp Ile Gly Thr Ala Thr Gln Leu Asp Ile Val Ala
 210 215 220
 Thr Phe Glu Val Asp Gln Ala Ala Leu Asn Ala Thr Ser Glu Thr Asp
 225 230 235 240
 Asp Ile Tyr Gly Cys Thr Thr Ser Leu Gly Ala Ala Gln Arg Gly Ser
 245 250 255
 Leu Gly Pro Phe Gly Leu Ala Val Leu Ala Asp Gly Thr Leu Ser Glu
 260 265 270
 Leu Thr Pro Val Tyr Phe Tyr Ile Ala Lys Lys Ala Asp Gly Gly Leu
 275 280 285
 Ser Thr His Phe Cys Thr Asp Lys Leu Arg Ser Ser Leu Asp Tyr Asp
 290 295 300
 Gly Gln Arg Val Val Tyr Gly Ser Thr Val Pro Val Leu Asp Asp Glu
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 Glu Leu Thr Met Arg Leu Leu Val Asp His Ser Ile Val Glu Gly Phe
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 Ala Gln Gly Gly Arg Thr Val Ile Thr Ser Arg Val Tyr Pro Thr Lys
 340 345 350
 Ala Ile Tyr Glu Gln Ala Lys Leu Phe Leu Phe Asn Asn Ala Thr Gly
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 <211> 1844
 <212> DNA
 <213> Triticum aestivum

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 <211> 495
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 <213> Triticum aestivum

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 35 40 45
 Tyr Thr Gly Ala Thr Asn Ala Ser Ala Ile Glu Val Gln Cys Ile Ala
 50 55 60
 Thr Pro Ala Asp Pro Asn Asp Pro Phe Leu Arg Arg Trp Thr Lys His
 65 70 75 80
 Pro Ala Asn Pro Val Ile Trp Ser Pro Pro Gly Ile Gly Thr Lys Asp
 85 90 95
 Phe Arg Asp Pro Met Thr Ala Trp Tyr Asp Glu Ser Asp Asp Thr Trp
 100 105 110
 Arg Thr Leu Leu Gly Ser Lys Asp Asp Gln Asp Gly His His Asp Gly
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 Ile Ala Met Met Tyr Lys Thr Lys Asp Phe Leu Asn Tyr Glu Leu Ile
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Ala His Asn Gln Leu Ser Asn Met Asp Asp Tyr Ser Tyr Val Gln
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<210> 9
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 <212> DNA
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 caccacgatg ggatcgccat gatgtacaag accaaggact tccttaacta cgagctcatc 360
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 gtcggccaca gaagcaacga caactcatcg gagatgttgc acgtgttgaa ggcgagcatg 480
 gacgacgaac ggacgacta ctactcgcta ggacgtacg actcggcagc aaacgcgtgg 540
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 <211> 471
 <212> PRT
 <213> Triticum aestivum

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 Pro Asn Gly Thr Val Ile Met Ile Tyr Thr Gly Ala Thr Asn Ala Ser
 20 25 30
 Ala Val Glu Val Gln Cys Ile Ala Thr Pro Ala Asp Pro Asn Asp Pro
 35 40 45
 Phe Leu Arg Arg Trp Thr Lys His Pro Ala Asn Pro Val Ile Trp Ser
 50 55 60
 Pro Pro Gly Ile Gly Thr Lys Asp Phe Arg Asp Pro Met Thr Ala Trp
 65 70 75 80
 Tyr Asp Glu Ser Asp Asp Thr Trp Arg Thr Leu Leu Gly Ser Lys Asp
 85 90 95

Thr Met Thr Ser Arg Val Tyr Pro Met Glu Ala Tyr Gln Glu Ala Lys
420 425 430

Val Tyr Leu Phe Asn Asn Ala Thr Gly Ala Ser Val Met Ala Glu Arg
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Leu Val Val His Glu Met Asp Ser Ala His Asn Gln Leu Ser Asn Met
450 455 460

Asp Asp His Ser Tyr Val Gln
465 470

<210> 11
<211> 476
<212> DNA
<213> Triticum aestivum

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atggactcag cacacaacca gctctccaat atggacgatt actcgtatgt tcaatgaagc 180
tcttgcatct catcagtaat aagctacatt ggatcaaaga cgctcaccaa ggaaggccaa 240
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gtcatgttct gcattgatgt cacagtgaac tatattactt tgttgggtgt aggatcgata 360
tagtttgggt ggggtggaact ttgtttgttt acatagtga cgggtgtggt ctgcataata 420
agcttatgtg tttgtttaga aaatgaatta ttgttggtta aaaaaaaaaa aaaaaa 476

<210> 12
<211> 58
<212> PRT
<213> Triticum aestivum

<400> 12
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Glu Ala Lys Val Tyr Leu Phe Asn Asn Ala Thr Gly Ala Ser Val Thr
20 25 30

Ala Glu Arg Leu Val Val His Glu Met Asp Ser Ala His Asn Gln Leu
35 40 45

Ser Asn Met Asp Asp Tyr Ser Tyr Val Gln
50 55

<210> 13
<211> 2093
<212> DNA
<213> Parthenium argentatum Grey

<400> 13
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ccacctcccc tctcattctc cacgatgatc ctgaaaacct ccaggaaccc accggattta 120
cgggggttgc tctgcatcc atcgcaaaag cgctttgcgt aacccttgtt tcggttatgg 180
taatctgtgg tctggttgct gtaatcagca accagacaca ggtaccacaa gtagccaaca 240
gccatcaagg tgccgccacc acattcacaa ctgagttgcc aaaaatagat atgaaacggg 300
ttccgggaga gttggattcg ggtgctgatg tccaatggca acgctccgct tatcattttc 360
aacctgacaa aaactacatt agtgatcctg atggcccaat gtatcacatg ggatgggtacc 420
atctatttta tcagtacaac ccagaatctg ccatatgggg caacatcaca tgggggtcact 480

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ccgtatccaa agacatgac aactgggtcc atctcccttt cgccatgggt ccggaccatt 540
ggtacgacat cgaaggcgtc atgacaggtt ccgccacagt cctcccaaac ggtgagatca 600
tcatgcttta caggggcaat gcgtacgac tctcccaagt acaatgctta gcgtacgcag 660
tcaactcadc agatccactt cttatagagt ggaaaaaata cgaaggcaac ccggttttat 720
tgccgcgcgc aggggtgggt tacaaggatt ttccggaccc atctacattg tggctgggccc 780
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tcccacatac tggatgtggg gaatgcgttg atctttatcc ggtatccacc acacacacaa 960
acgggttggg catggtggat aatgggccaa atgtaaaata cgtgttgaaa caaagtgggg 1020
atgaagatcg ccattgattg tatgcgattg gaagttatga ttgggtgaat gataagtggg 1080
accgggatga ccgggaaaac gatgtgggta tcgggttaag atacgattac ggaaagtttt 1140
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gagaaaccga tcccgaaaag tatgacctta caaagggatg ggctaacata ttgaatattc 1260
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cgtcaagaac ctacttttgt gctgatgaaa caagatcatc caaggatgta gacgtgggga 1680
aatgggtgta tggaagcagt gttcctgtcc tccctaacga aaagtacaat atgaggttac 1740
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gagtgtatcc aacgaaggca atttacaacg ctgcgaaggt gtttttgttc aacaacgcga 1860
ccgggattag ggtgaaggcg tcggtcaaga tttggaagat ggcggaagca gaactcaacc 1920
ctttcccgat tactgggtgg acttcttgat ggctagattt tggtccttat atgtgtgtgt 1980
tactatcgtg aggtatatgt cttggactgt gggggtatta ttgtaatttg atatgtatgt 2040
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<210> 14
 <211> 635
 <212> PRT
 <213> *Parthenium argentatum* Grey

<400> 14
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 Pro Glu Asn Leu Gln Glu Pro Thr Gly Phe Thr Gly Val Arg Arg Pro
 20 25 30
 Ser Ile Ala Lys Ala Leu Cys Val Thr Leu Val Ser Val Met Val Ile
 35 40 45
 Cys Gly Leu Val Ala Val Ile Ser Asn Gln Thr Gln Val Pro Gln Val
 50 55 60
 Ala Asn Ser His Gln Gly Ala Ala Thr Thr Phe Thr Thr Gln Leu Pro
 65 70 75 80
 Lys Ile Asp Met Lys Arg Val Pro Gly Glu Leu Asp Ser Gly Ala Asp
 85 90 95
 Val Gln Trp Gln Arg Ser Ala Tyr His Phe Gln Pro Asp Lys Asn Tyr
 100 105 110
 Ile Ser Asp Pro Asp Gly Pro Met Tyr His Met Gly Trp Tyr His Leu
 115 120 125
 Phe Tyr Gln Tyr Asn Pro Glu Ser Ala Ile Trp Gly Asn Ile Thr Trp
 130 135 140

Gly	His	Ser	Val	Ser	Lys	Asp	Met	Ile	Asn	Trp	Phe	His	Leu	Pro	Phe	145	150	155	160
Ala	Met	Val	Pro	Asp	His	Trp	Tyr	Asp	Ile	Glu	Gly	Val	Met	Thr	Gly	165	170	175	
Ser	Ala	Thr	Val	Leu	Pro	Asn	Gly	Glu	Ile	Ile	Met	Leu	Tyr	Thr	Gly	180	185	190	
Asn	Ala	Tyr	Asp	Leu	Ser	Gln	Val	Gln	Cys	Leu	Ala	Tyr	Ala	Val	Asn	195	200	205	
Ser	Ser	Asp	Pro	Leu	Leu	Ile	Glu	Trp	Lys	Lys	Tyr	Glu	Gly	Asn	Pro	210	215	220	
Val	Leu	Leu	Pro	Pro	Pro	Gly	Val	Gly	Tyr	Lys	Asp	Phe	Arg	Asp	Pro	225	230	235	240
Ser	Thr	Leu	Trp	Leu	Gly	Pro	Asp	Gly	Glu	Tyr	Arg	Met	Val	Met	Gly	245	250	255	
Ser	Lys	His	Asn	Glu	Thr	Ile	Gly	Cys	Ala	Leu	Ile	Tyr	His	Thr	Thr	260	265	270	
Asn	Phe	Thr	His	Phe	Glu	Leu	Asn	Glu	Glu	Val	Leu	His	Ala	Val	Pro	275	280	285	
His	Thr	Gly	Met	Trp	Glu	Cys	Val	Asp	Leu	Tyr	Pro	Val	Ser	Thr	Thr	290	295	300	
His	Thr	Asn	Gly	Leu	Asp	Met	Val	Asp	Asn	Gly	Pro	Asn	Val	Lys	Tyr	305	310	315	320
Val	Leu	Lys	Gln	Ser	Gly	Asp	Glu	Asp	Arg	His	Asp	Trp	Tyr	Ala	Ile	325	330	335	
Gly	Ser	Tyr	Asp	Trp	Val	Asn	Asp	Lys	Trp	Tyr	Pro	Asp	Asp	Pro	Glu	340	345	350	
Asn	Asp	Val	Gly	Ile	Gly	Leu	Arg	Tyr	Asp	Tyr	Gly	Lys	Phe	Tyr	Ala	355	360	365	
Ser	Lys	Thr	Phe	Tyr	Asp	Gln	His	Lys	Lys	Arg	Arg	Val	Leu	Trp	Gly	370	375	380	
Tyr	Val	Gly	Glu	Thr	Asp	Pro	Glu	Lys	Tyr	Asp	Leu	Thr	Lys	Gly	Trp	385	390	395	400
Ala	Asn	Ile	Leu	Asn	Ile	Pro	Arg	Thr	Val	Val	Leu	Asp	Thr	Lys	Thr	405	410	415	
Lys	Thr	Asn	Leu	Ile	Gln	Trp	Pro	Ile	Glu	Glu	Thr	Glu	Lys	Leu	Arg	420	425	430	
Ser	Lys	Lys	Tyr	Asp	Lys	Phe	Val	Asp	Val	Glu	Leu	Arg	Pro	Gly	Ser	435	440	445	
Leu	Ile	Pro	Leu	Glu	Ile	Gly	Thr	Ala	Thr	Gln	Leu	Asp	Ile	Val	Ala	450	455	460	

Thr Phe Glu Val Asp Gln Met Met Leu Glu Ser Thr Leu Glu Ala Asp
 465 470 475 480
 Val Leu Phe Asn Cys Thr Thr Ser Val Gly Ser Val Gly Arg Gly Val
 485 490 495
 Leu Gly Pro Phe Gly Val Val Val Leu Ala Asp Ala Gln Arg Thr Glu
 500 505 510
 Gln Leu Pro Val Tyr Phe Tyr Ile Ala Lys Asp Thr Asp Gly Thr Ser
 515 520 525
 Arg Thr Tyr Phe Cys Ala Asp Glu Thr Arg Ser Ser Lys Asp Val Asp
 530 535 540
 Val Gly Lys Trp Val Tyr Gly Ser Ser Val Pro Val Leu Pro Asn Glu
 545 550 555 560
 Lys Tyr Asn Met Arg Leu Leu Val Asp His Ser Ile Val Glu Gly Phe
 565 570 575
 Ala Gln Asn Gly Arg Thr Val Val Thr Ser Arg Val Tyr Pro Thr Lys
 580 585 590
 Ala Ile Tyr Asn Ala Ala Lys Val Phe Leu Phe Asn Asn Ala Thr Gly
 595 600 605
 Ile Arg Val Lys Ala Ser Val Lys Ile Trp Lys Met Ala Glu Ala Glu
 610 615 620
 Leu Asn Pro Phe Pro Val Thr Gly Trp Thr Ser
 625 630 635

<210> 15
 <211> 2107
 <212> DNA
 <213> Helianthus sp.

<400> 15
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 agaactcacc ggatctccga caactcgtcg tctatccatc gcaaaagtgc tttcggggat 180
 ccttgtttcg gttctagtta catgtgctct tgttgcttta atcaacaacc aaacatatga 240
 accaccgcg gccaccacat tcgcaactca gttgccaaat attgatctga agcggggttc 300
 aggaaagtgt gattcgagtgt ctgaggttga atggcaacga tccgcttatc attttcaacc 360
 cgacaaaaat ttcattagtgt atcctgatgg cccaatgtat cacatgggat ggtaccatct 420
 attctatcag tacaaccctg aatctgccat ctggggcaac atcacatggg gccactcggg 480
 atcgaaagac atgatcaact ggttccatct ccttttcgcc atggttcctg accattggta 540
 cgacatcgaa ggtgtcatga cgggttcggc tacagtcctc cctaattggc aaatcatcat 600
 gctttacacg ggcaacgcgt acgatctctc ccaagtacaa tgcttggcat acgctgtcaa 660
 ctgctcggtat ccccttctta tagagtggaa aaaatatgaa ggtaaccctg tcttggtccc 720
 accaccagga gtgggctaca aggactttcg ggacccatcc acattgtggg tgggccctga 780
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 ggatgacctg gaaaatgatg tgggtattgg attaatgat gattttggaa aattttatgc 1140
 gtccaagact ttttatgacc aacataagaa gaggagggtc ctttggggct atgttgagga 1200


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aaccgatccc caaaagtatg acattttcaaa gggatgggct aacattttga atattccaag 1260
aaccgtcggt ttggacacaa aaacccaaaac caatttgatt caatggccaa tcgaggaaac 1320
cgaaaacott aggtcaaaaa cgtacgatga atttaaagac gtggagcttc gaccggggtc 1380
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tatcatgaag cataagtttg gactggaggg ggtattattg taattttata tgcattgttct 2040
attacttgtg agtttatagt atataattaa attattatta ttaaaaaaaaa aaaaaaaaaa 2100
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<210> 16
 <211> 630
 <212> PRT
 <213> Helianthus sp.

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<400> 16
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Pro Glu Asn Leu Pro Glu Leu Thr Gly Ser Pro Thr Thr Arg Arg Leu
          20              25              30

Ser Ile Ala Lys Val Leu Ser Gly Ile Leu Val Ser Val Leu Val Thr
          35              40              45

Cys Ala Leu Val Ala Leu Ile Asn Asn Gln Thr Tyr Glu Pro Pro Ala
          50              55              60

Ala Thr Thr Phe Ala Thr Gln Leu Pro Asn Ile Asp Leu Lys Arg Val
          65              70              75              80

Pro Gly Lys Leu Asp Ser Ser Ala Glu Val Glu Trp Gln Arg Ser Ala
          85              90              95

Tyr His Phe Gln Pro Asp Lys Asn Phe Ile Ser Asp Pro Asp Gly Pro
          100              105              110

Met Tyr His Met Gly Trp Tyr His Leu Phe Tyr Gln Tyr Asn Pro Glu
          115              120              125

Ser Ala Ile Trp Gly Asn Ile Thr Trp Gly His Ser Val Ser Lys Asp
          130              135              140

Met Ile Asn Trp Phe His Leu Pro Phe Ala Met Val Pro Asp His Trp
          145              150              155              160

Tyr Asp Ile Glu Gly Val Met Thr Gly Ser Ala Thr Val Leu Pro Asn
          165              170              175

Gly Gln Ile Ile Met Leu Tyr Thr Gly Asn Ala Tyr Asp Leu Ser Gln
          180              185              190

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Val Gln Cys Leu Ala Tyr Ala Val Asn Ser Ser Asp Pro Leu Leu Ile
195 200 205

Glu Trp Lys Lys Tyr Glu Gly Asn Pro Val Leu Phe Pro Pro Pro Gly
210 215 220

Val Gly Tyr Lys Asp Phe Arg Asp Pro Ser Thr Leu Trp Leu Gly Pro
225 230 235 240

Asp Gly Glu Tyr Arg Met Val Met Gly Ser Lys His Asn Glu Thr Ile
245 250 255

Gly Cys Ala Leu Ile Tyr His Thr Thr Asn Phe Thr His Phe Glu Leu
260 265 270

Lys Glu Glu Val Leu His Ala Val Pro His Thr Gly Met Trp Glu Cys
275 280 285

Val Asp Leu Tyr Pro Val Ser Thr Val His Thr Asn Gly Leu Asp Met
290 295 300

Val Asp Asn Gly Pro Asn Val Lys Tyr Val Leu Lys Gln Ser Gly Asp
305 310 315 320

Glu Asp Arg His Asp Trp Tyr Ala Ile Gly Ser Tyr Asp Val Val Asn
325 330 335

Asp Lys Trp Tyr Pro Asp Asp Pro Glu Asn Asp Val Gly Ile Gly Leu
340 345 350

Arg Tyr Asp Phe Gly Lys Phe Tyr Ala Ser Lys Thr Phe Tyr Asp Gln
355 360 365

His Lys Lys Arg Arg Val Leu Trp Gly Tyr Val Gly Glu Thr Asp Pro
370 375 380

Gln Lys Tyr Asp Ile Ser Lys Gly Trp Ala Asn Ile Leu Asn Ile Pro
385 390 395 400

Arg Thr Val Val Leu Asp Thr Lys Thr Lys Thr Asn Leu Ile Gln Trp
405 410 415

Pro Ile Glu Glu Thr Glu Asn Leu Arg Ser Lys Thr Tyr Asp Glu Phe
420 425 430

Lys Asp Val Glu Leu Arg Pro Gly Ser Leu Val Pro Leu Glu Ile Gly
435 440 445

Thr Ala Thr Gln Leu Asp Ile Val Ala Thr Phe Glu Ile Asp Gln Lys
450 455 460

Met Leu Glu Ser Thr Leu Glu Ala Asp Val Leu Phe Asn Cys Thr Thr
465 470 475 480

Ser Glu Gly Ser Val Ala Arg Gly Ala Leu Gly Pro Phe Gly Val Val
485 490 495

Val Leu Ala Asp Ala Gln Arg Ser Glu Gln Leu Pro Val Tyr Phe Tyr
500 505 510

Ile Ala Lys Asp Ile Asp Gly Thr Ser Arg Thr Tyr Phe Cys Ala Asp
 515 520 525
 Glu Thr Arg Ser Ser Lys Asp Val Ser Val Gly Lys Trp Val Tyr Gly
 530 535 540
 Ser Ser Val Pro Val Leu Pro Gly Glu Lys Tyr Asn Met Arg Leu Leu
 545 550 555 560
 Val Asp His Ser Ile Val Glu Gly Phe Ala Gln Asn Gly Arg Thr Val
 565 570 575
 Val Thr Ser Arg Val Tyr Pro Thr Lys Ala Ile Tyr Asn Ala Ala Lys
 580 585 590
 Val Phe Leu Phe Asn Asn Ala Thr Gly Ile Ser Val Lys Ala Ser Ile
 595 600 605
 Lys Ile Trp Lys Met Ala Lys Ala Glu Leu Asn Pro Phe Pro Leu Pro
 610 615 620
 Gly Trp Thr Phe Glu Leu
 625 630
 <210> 17
 <211> 615
 <212> PRT
 <213> Helianthus tuberosus
 <400> 17
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 20 25 30
 Pro Leu Phe Thr Arg Val Val Ser Gly Val Thr Phe Val Leu Phe Phe
 35 40 45
 Phe Gly Phe Ala Ile Val Phe Ile Val Leu Asn Gln Gln Asn Ser Ser
 50 55 60
 Val Arg Ile Val Thr Asn Ser Glu Lys Ser Phe Ile Arg Tyr Ser Gln
 65 70 75 80
 Thr Asp Arg Leu Ser Trp Glu Arg Thr Ala Phe His Phe Gln Pro Ala
 85 90 95
 Lys Asn Phe Ile Tyr Asp Pro Asp Gly Gln Leu Phe His Met Gly Trp
 100 105 110
 Tyr His Met Phe Tyr Gln Tyr Asn Pro Tyr Ala Pro Val Trp Gly Asn
 115 120 125
 Met Ser Trp Gly His Ser Val Ser Lys Asp Met Ile Asn Trp Tyr Glu
 130 135 140
 Leu Pro Val Ala Met Val Pro Thr Glu Trp Tyr Asp Ile Glu Gly Val
 145 150 155 160

Ser Leu Gly Pro Phe Gly Leu Ala Val Leu Ala Asp Gly Thr Leu Ser
 485 490 495
 Glu Leu Thr Pro Val Tyr Phe Tyr Ile Ala Lys Lys Ala Asp Gly Gly
 500 505 510
 Val Ser Thr His Phe Cys Thr Asp Lys Leu Arg Ser Ser Leu Asp Tyr
 515 520 525
 Asp Gly Glu Arg Val Val Tyr Gly Gly Thr Val Pro Val Leu Asp Asp
 530 535 540
 Glu Glu Leu Thr Met Arg Leu Leu Val Asp His Ser Ile Val Glu Gly
 545 550 555 560
 Phe Ala Gln Gly Gly Arg Thr Val Ile Thr Ser Arg Ala Tyr Pro Thr
 565 570 575
 Lys Ala Ile Tyr Glu Gln Ala Lys Leu Phe Leu Phe Asn Asn Ala Thr
 580 585 590
 Gly Thr Ser Val Lys Ala Ser Leu Lys Ile Trp Gln Met Ala Ser Ala
 595 600 605
 Pro Ile His Gln Tyr Pro Phe
 610 615

<210> 18
 <211> 630
 <212> PRT
 <213> Helianthus tuberosus

<400> 18
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 Pro Glu Asn Leu Pro Glu Leu Thr Gly Ser Pro Thr Thr Arg Arg Leu
 20 25 30
 Ser Ile Ala Lys Val Leu Ser Gly Ile Leu Val Ser Val Leu Val Ile
 35 40 45
 Gly Ala Leu Val Ala Leu Ile Asn Asn Gln Thr Tyr Glu Ser Pro Ser
 50 55 60
 Ala Thr Thr Phe Val Thr Gln Leu Pro Asn Ile Asp Leu Lys Arg Val
 65 70 75 80
 Pro Gly Lys Leu Asp Ser Ser Ala Glu Val Glu Trp Gln Arg Ser Thr
 85 90 95
 Tyr His Phe Gln Pro Asp Lys Asn Phe Ile Ser Asp Pro Asp Gly Pro
 100 105 110
 Met Tyr His Met Gly Trp Tyr His Leu Phe Tyr Gln Tyr Asn Pro Gln
 115 120 125
 Ser Ala Ile Trp Gly Asn Ile Thr Trp Gly His Ser Val Ser Lys Asp
 130 135 140

Met	Ile	Asn	Trp	Phe	His	Leu	Pro	Phe	Ala	Met	Val	Pro	Asp	His	Trp	145	150	155	160
Tyr	Asp	Ile	Glu	Gly	Val	Met	Thr	Gly	Ser	Ala	Thr	Val	Leu	Pro	Asn	165	170	175	
Gly	Gln	Ile	Ile	Met	Leu	Tyr	Ser	Gly	Asn	Ala	Tyr	Asp	Leu	Ser	Gln	180	185	190	
Val	Gln	Cys	Leu	Ala	Tyr	Ala	Val	Asn	Ser	Ser	Asp	Pro	Leu	Leu	Ile	195	200	205	
Glu	Trp	Lys	Lys	Tyr	Glu	Gly	Asn	Pro	Val	Leu	Leu	Pro	Pro	Pro	Gly	210	215	220	
Val	Gly	Tyr	Lys	Asp	Phe	Arg	Asp	Pro	Ser	Thr	Leu	Trp	Ser	Gly	Pro	225	230	235	240
Asp	Gly	Glu	Tyr	Arg	Met	Val	Met	Gly	Ser	Lys	His	Asn	Glu	Thr	Ile	245	250	255	
Gly	Cys	Ala	Leu	Ile	Tyr	His	Thr	Thr	Asn	Phe	Thr	His	Phe	Glu	Leu	260	265	270	
Lys	Glu	Glu	Val	Leu	His	Ala	Val	Pro	His	Thr	Gly	Met	Trp	Glu	Cys	275	280	285	
Val	Asp	Leu	Tyr	Pro	Val	Ser	Thr	Val	His	Thr	Asn	Gly	Leu	Asp	Met	290	295	300	
Val	Asp	Asn	Gly	Pro	Asn	Val	Lys	Tyr	Val	Leu	Lys	Gln	Ser	Gly	Asp	305	310	315	320
Glu	Asp	Arg	His	Asp	Trp	Tyr	Ala	Ile	Gly	Ser	Tyr	Asp	Ile	Val	Asn	325	330	335	
Asp	Lys	Trp	Tyr	Pro	Asp	Asp	Pro	Glu	Asn	Asp	Val	Gly	Ile	Gly	Leu	340	345	350	
Arg	Tyr	Asp	Phe	Gly	Lys	Phe	Tyr	Ala	Ser	Lys	Thr	Phe	Tyr	Asp	Gln	355	360	365	
His	Lys	Lys	Arg	Arg	Val	Leu	Trp	Gly	Tyr	Val	Gly	Glu	Thr	Asp	Pro	370	375	380	
Gln	Lys	Tyr	Asp	Leu	Ser	Lys	Gly	Trp	Ala	Asn	Ile	Leu	Asn	Ile	Pro	385	390	395	400
Arg	Thr	Val	Val	Leu	Asp	Leu	Glu	Thr	Lys	Thr	Asn	Leu	Ile	Gln	Trp	405	410	415	
Pro	Ile	Glu	Glu	Thr	Glu	Asn	Leu	Arg	Ser	Lys	Lys	Tyr	Asp	Glu	Phe	420	425	430	
Lys	Asp	Val	Glu	Leu	Arg	Pro	Gly	Ala	Leu	Val	Pro	Leu	Glu	Ile	Gly	435	440	445	
Thr	Ala	Thr	Gln	Leu	Asp	Ile	Val	Ala	Thr	Phe	Glu	Ile	Asp	Gln	Lys	450	455	460	


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<212> PRT
<213> Triticum aestivum

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Arg Ser Gly Gln Glu Pro Leu Ala Val Leu Val Ser Ala Lys Asn Gln
          20             25             30

Ser Ser Ser Glu Glu Arg Ala Gly Gly Gly Leu Arg Val Asp Glu Glu
  35             40             45

Ala Ala Ala Gly Phe Pro Trp Ser Asn Glu Met Leu Gln Trp Gln Arg
  50             55             60

Ser Gly Tyr His Phe Gln Thr Ala Lys Asn Tyr Met Ser Asp Pro Asn
  65             70             75             80

Gly Leu Met Tyr Tyr Asn Gly Trp Tyr His Met Phe Phe Gln Tyr Asn
          85             90             95

Pro Val Gly Thr Asp Trp Asp Asp Gly Met Glu Trp Gly His Ala Val
  100            105            110

Ser Arg Asn Leu Val Thr Trp Arg Thr Leu Pro Ile Ala Met Val Ala
  115            120            125

Asp Gln Trp Tyr Asp Ile Leu Gly Val Leu Ser Gly Ser Met Thr Val
  130            135            140

Leu Pro Asn Gly Thr Val Ile Met Ile Tyr Thr Gly Ala Thr Asn Ala
  145            150            155            160

Ser Ala Val Glu Val Gln Cys Ile Ala Thr Pro Ala Asp Pro Asn Asp
          165            170            175

Pro Phe Leu Arg Arg Trp Thr Lys His Pro Ala Asn Pro Val Ile Trp
  180            185            190

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Ser Pro Pro Gly Ile Gly Thr Lys Asp Phe Arg Asp Pro Met Thr Ala
 195 200 205
 Trp Tyr Asp Glu Ser Asp Asp Thr Trp Arg Thr Leu Leu Gly Ser Lys
 210 215 220
 Asp Asp His Asp Gly His His Asp Gly Ile Ala Met Met Tyr Lys Thr
 225 230 235 240
 Lys Asp Phe Leu Asn Tyr Glu Leu Ile Pro Gly Ile Leu His Arg Val
 245 250 255
 Gln Arg Thr Gly Glu Trp Glu Cys Ile Asp Phe Tyr Pro Val Gly His
 260 265 270
 Arg Ser Asn Asp Asn Ser Ser Glu Met Leu His Val Leu Lys Ala Ser
 275 280 285
 Met Asp Asp Glu Arg His Asp Tyr Tyr Ser Leu Gly Thr Tyr Asp Ser
 290 295 300
 Ala Ala Asn Ala Trp Thr Pro Ile Asp Pro Glu Leu Asp Leu Gly Ile
 305 310 315 320
 Gly Leu Arg Tyr Asp Trp Gly Lys Phe Tyr Ala Ser Thr Ser Phe Tyr
 325 330 335
 Asp Pro Ala Lys Lys Arg Arg Val Leu Met Gly Tyr Val Gly Glu Val
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 Asp Ser Lys Arg Ala Asp Val Val Lys Gly Trp Ala Ser Ile Gln Ser
 355 360 365
 Val Pro Arg Thr Ile Ala Leu Asp Glu Lys Thr Arg Thr Asn Leu Leu
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 Leu Trp Pro Val Glu Glu Ile Glu Thr Leu Arg Leu Asn Ala Thr Glu
 385 390 395 400
 Leu Ser Asp Val Thr Leu Asn Thr Gly Ser Val Ile His Ile Pro Leu
 405 410 415
 Arg Gln Gly Thr Gln Leu Asp Ile Glu Ala Thr Phe His Leu Asp Ala
 420 425 430
 Ser Ala Val Ala Ala Leu Asn Glu Ala Asp Val Gly Tyr Asn Cys Ser
 435 440 445
 Ser Ser Gly Gly Ala Val Asn Arg Gly Ala Leu Gly Pro Phe Gly Leu
 450 455 460
 Leu Val Leu Ala Ala Gly Asp Arg Arg Gly Glu Gln Thr Ala Val Tyr
 465 470 475 480
 Phe Tyr Val Ser Arg Gly Leu Asp Gly Gly Leu His Thr Ser Phe Cys
 485 490 495
 Gln Asp Glu Leu Arg Ser Ser Arg Ala Lys Asp Val Thr Lys Arg Val
 500 505 510

Ile Gly Ser Thr Val Pro Val Leu Asp Gly Glu Ala Phe Ser Met Arg
515 520 525

Val Leu Val Asp His Ser Ile Val Gln Gly Phe Ala Met Gly Gly Arg
530 535 540

Thr Thr Met Thr Ser Arg Val Tyr Pro Met Glu Ala Tyr Gln Glu Ala
545 550 555 560

Lys Val Tyr Leu Phe Asn Asn Ala Thr Gly Ala Ser Val Met Ala Glu
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Arg Leu Val Val His Glu Met Asp Ser Ala His Asn Gln Leu Ser Asn
580 585 590

Met Asp Asp His Ser Tyr Val Gln
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Ala Cys Ala Thr Val Leu Thr Ala Ser Ala Met Ala Val Val Val Val
35 40 45

Gly Ala Thr Leu Leu Ala Gly Leu Arg Met Glu Gln Ala Val Asp Glu
50 55 60

Glu Ala Ala Ala Gly Gly Phe Pro Trp Ser Asn Glu Met Leu Gln Trp
65 70 75 80

Gln Arg Ser Gly Tyr His Phe Gln Thr Ala Lys Asn Tyr Met Ser Asp
85 90 95

Pro Asn Gly Leu Met Tyr Tyr Arg Gly Trp Tyr His Met Phe Tyr Gln
100 105 110

Tyr Asn Pro Val Gly Thr Asp Trp Asp Asp Gly Met Glu Trp Gly His
115 120 125

Ala Val Ser Arg Asn Leu Val Gln Trp Arg Thr Leu Pro Ile Ala Met
130 135 140

Val Ala Asp Gln Trp Tyr Asp Ile Leu Gly Val Leu Ser Gly Ser Met
145 150 155 160

Thr Val Leu Pro Asn Gly Thr Val Ile Met Ile Tyr Thr Gly Ala Thr
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Asn Ala Ser Ala Val Glu Val Gln Cys Ile Ala Thr Pro Ala Asp Pro
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Ile	Trp	Ser	Pro	Pro	Gly	Val	Gly	Thr	Lys	Asp	Phe	Arg	Asp	Pro	Met
	210					215					220				
Thr	Ala	Trp	Tyr	Asp	Glu	Ser	Asp	Glu	Thr	Trp	Arg	Thr	Leu	Leu	Gly
225					230					235					240
Ser	Lys	Asp	Asp	His	Asp	Gly	His	His	Asp	Gly	Ile	Ala	Met	Met	Tyr
				245					250					255	
Lys	Thr	Lys	Asp	Phe	Leu	Asn	Tyr	Glu	Leu	Ile	Pro	Gly	Ile	Leu	His
			260					265					270		
Arg	Val	Val	Arg	Thr	Gly	Glu	Trp	Glu	Cys	Ile	Asp	Phe	Tyr	Pro	Val
		275					280					285			
Gly	Arg	Arg	Ser	Ser	Asp	Asn	Ser	Ser	Glu	Met	Leu	His	Val	Leu	Lys
	290					295					300				
Ala	Ser	Met	Asp	Asp	Glu	Arg	His	Asp	Tyr	Tyr	Ser	Leu	Gly	Thr	Tyr
305					310				315						320
Asp	Ser	Ala	Ala	Asn	Thr	Trp	Thr	Pro	Ile	Asp	Pro	Glu	Leu	Asp	Leu
				325					330					335	
Gly	Ile	Gly	Leu	Arg	Tyr	Asp	Trp	Gly	Lys	Phe	Tyr	Ala	Ser	Thr	Ser
			340					345					350		
Phe	Tyr	Asp	Pro	Ala	Lys	Asn	Arg	Arg	Val	Leu	Met	Gly	Tyr	Val	Gly
		355					360					365			
Glu	Val	Asp	Ser	Lys	Arg	Ala	Asp	Val	Val	Lys	Gly	Trp	Ala	Ser	Ile
	370					375					380				
Gln	Ser	Val	Pro	Arg	Thr	Val	Ala	Leu	Asp	Glu	Lys	Thr	Arg	Thr	Asn
385					390					395					400
Leu	Leu	Leu	Trp	Pro	Val	Glu	Glu	Ile	Glu	Thr	Leu	Arg	Leu	Asn	Ala
				405					410					415	
Thr	Glu	Leu	Thr	Asp	Val	Thr	Ile	Asn	Thr	Gly	Ser	Val	Ile	His	Ile
			420					425					430		
Pro	Leu	Arg	Gln	Gly	Thr	Gln	Leu	Asp	Ile	Glu	Ala	Ser	Phe	His	Leu
		435					440					445			
Asp	Ala	Ser	Ala	Val	Ala	Ala	Leu	Asn	Glu	Ala	Asp	Val	Gly	Tyr	Asn
	450					455					460				
Cys	Ser	Ser	Ser	Gly	Gly	Ala	Val	Asn	Arg	Gly	Ala	Leu	Gly	Pro	Phe
465					470					475					480
Gly	Leu	Leu	Val	Leu	Ala	Ala	Gly	Asp	Arg	Arg	Gly	Glu	Gln	Thr	Ala
				485				490						495	
Val	Tyr	Phe	Tyr	Val	Ser	Arg	Gly	Leu	Asp	Gly	Gly	Leu	His	Thr	Ser
			500					505					510		

Phe Cys Gln Asp Glu Leu Arg Ser Ser Arg Ala Lys Asp Val Thr Lys
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Arg Val Ile Gly Ser Thr Val Pro Val Leu Asp Gly Glu Ala Leu Ser
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Met Arg Val Leu Val Asp His Ser Ile Val Gln Gly Phe Asp Met Gly
545 550 555 560

Gly Arg Thr Thr Met Thr Ser Arg Val Tyr Pro Met Glu Ser Tyr Gln
565 570 575

Glu Ala Arg Val Tyr Leu Phe Asn Asn Ala Thr Gly Ala Ser Val Thr
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Ala Glu Arg Leu Val Val His Glu Met Asp Ser Ala His Asn Gln Leu
595 600 605

Ser Asn Glu Asp Asp Gly Met Tyr Leu His Gln Val Leu Glu Ser Arg
610 615 620

His
625